Fact Sheet

RAPID METHOD TO DETERMINE FREEZE-THAW RESISTANCE OF AGGREGATE

TECHNOLOGY CHALLENGE

Freezing and thawing deterioration of concrete is of great concern to highway officials. When water freezes in coarse aggregate, sufficient stress can build up to crack the pavement. Damage normally begins in portions of pave-ment nearest to sources of water, at the bottom of the pavement and near vertical joints. As a consequence, once damage becomes apparent, deterioration is extensive and expensive to repair. The usual method of identifying freeze–thaw durable aggregate relies on service records and on laboratory testing. As reliable aggregate sources be-come depleted, the emphasis is shifted to laboratory test methods for determining durable aggregate. The problem with this is that the time required to conduct current laboratory test methods frequently exceeds the available design period. A faster test method is desirable.

DESCRIPTION OF THE PRODUCT

The objective of this work was to explore innovative ways for rapidly differentiating durable from nondurable aggregate. The goal was to provide an improved understanding of freeze–thaw deterioration and to recommend potential tests for rapidly identifying durable aggregate.

STATUS OF PROJECT

This project has been completed. A report detailing five modules of work has been prepared. The results clearly indicate that the quality of coarse aggregate, particularly that related to pore-size distribution, has a significant effect upon pavement life in a cold climate. A test that cycles aggregate between liquid nitrogen and hot water proved to be a very quick way to screen out nondurable aggregate samples. It was recommended that cryogenic testing be evaluated further as a method to correlate the new test results with the field performance of pavements. Further development of a companion test to measure pore characteristics of aggregate was also recommended. The development of concrete mixtures that are more impervious to freeze–thaw, and the use of pore-blocking treatment for moisture-sensitive aggregate, were seen as possible alternatives to the selection of aggregates using accept/reject criteria based solely upon durability test results.

PARTNERING

This project is a Corps of Engineers Construction Productivity Advancement Research (CPAR) project, which is a cost-shared, cooperative research program designed to enhance the competitiveness of the United States con-struction industry. The U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL) was partnering with the Michigan Department of Transportation (MDOT).

COST SHARING

The total cost of the project, $180,000, was evenly split between the MDOT ($90,000) and USACRREL ($90,000).

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